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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
HICKS, MICHAEL J	
ART UNIT	PAPER NUMBER
2165	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/23/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)
	10/757,801	WANG, BING
	Examiner	Art Unit
	Michael J. Hicks	2165

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 February 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-21* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-21 Pending

Response to Arguments

2. Applicant's arguments, see After-Final Amendment, filed 2/27/2007, with respect to the rejection(s) of claim(s) 1-21 under USC 103 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Sahni et al. ("Data Structures For One-Dimensional Packet Classification Using Most-Specific-Rule Matching", Proc. Of the International Symposium on Parallel Architectures, Algorithms and Networks, 2002, IEEE and referred to hereinafter as Sahni).

Additionally, the proposed Claim amendments will be entered.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-21 rejected under 35 U.S.C. 102(b) as being anticipated by Sahni.

As per Claims 1, 11, and 21, Sahni discloses a method and device for associating at least one rule with a key (i.e. *"Each rule-table rule is a pair of the form (F;A), where F is a filter and A is an action. The action component of a rule specifies what is to be done when a packet that satisfies the rule filter is received...For the 1-dimensional packet classification problem, we assume that the single field in the filter is the destination field and that the action is the next hop for the packet."* The preceding text excerpt clearly indicates that rules are associated with keys (e.g. packet destinations).) (Page 1, Column 1, Paragraph 1. Column 2, Paragraph 1), comprising: arranging a plurality of objects in a table based on an ordering of information associated with each object (i.e. *"For the 1-dimensional packet classification problem, we assume that the single field in the filter is the destination field and that the action is the next hop for the packet. With these assumptions, 1-dimensional packet classification is equivalent to the destination-based packet forwarding problem. Henceforth, we shall use the terms rule table and router table to mean tables in which the filters have a single field, which is the destination address. This single field of a filter may be specified in one of two ways: 1. As a range. For example, the range [35,2096] matches all destination addresses d such that 35 < d < 2096."* The preceding text excerpt clearly indicates that a table of objects (e.g. key ranges) is arranged based on an ordering of the ranges of destinations to which the rules apply. See Figure 1.) (Page 1, Column 2, Paragraph 3) wherein each object defines a key range comprising at least one key value and at least one of the key ranges comprises multiple key values (i.e. *"Notice that every prefix may be represented as a range. For example, when W = 6, the prefix 10* is equivalent to the range [32, 47]. A range that may be specified as a prefix for some W is called a prefix range. The specification 101100/011101 may be abbreviated to ?011?0, where ? denotes a don't-care bit. This specification is not equivalent to any single range. Also, the range specification [3,6] isn't equivalent to any single address/mask specification."* The preceding text excerpt clearly indicates that the objects may be key ranges.) (Figure 1; Page 2, Column 1, Paragraph 3); if the key is provided, employing a search method to determine a starting object entry in the table (i.e. See Pages 3-4, Section

2.2 **End-Point Array** which clearly indicates that a search method is used to determine a starting object entry in the table when a key (d) is provided); if the key range of the starting object entry in the table is unequal to the provided key, employing another search method to determine at least one object in the table that defines a smallest key range that includes the provided key (i.e. *"Most-specific-rule matching. The filter F1 is more specific than the filter F2 if F2 matches all packets matched by F1 plus at least one additional packet. So, for example, the range [2; 4] is more specific than [1; 6], and [5; 9] is more specific than [5; 12]. Since [2; 4] and [8; 14] are disjoint (i.e., they have no address in common), neither is more specific than the other. Also, since [4; 14] and [6; 20] intersect2, neither is more specific than the other. The prefix 110* is more specific than the prefix 11*. In most-specific-rule matching, ties are broken by selecting the matching rule that has the most specific filter. When the filters are destination prefixes, the most specific- rule that matches a given destination d is the longest prefix in filters(d). Hence, for prefix filters, the most-specific-rule tie breaker is equivalent to the longest-matching-prefix criteria used in router tables. For our example rule set, when the destination address is 18, the longest matching-prefix is P4."* The preceding text excerpt clearly indicates that when multiple filters (e.g. key ranges) satisfy the key, the filter with the smallest range is selected. Note that since filters should be unique, and are ranges, the key will not be equal to any one filter, as the key is a single destination address, and if a filter comprises the single destination address, then it will be selected.) (Page 2, Column 2, Paragraphs 6-7; Page 3, Column 1, Paragraph 1); and enabling the processing of the provided key based on at least one rule associated with the determined object wherein the at least one rule applies to all key values of the key range of the determined object (i.e. *"Suppose that our router table is comprised of five rules R1–R5 and that the filters for these five rules are P1–P5, respectively. Let N1–N5, respectively, be the next hops for these five rules. The destination address 18 is matched by rules R1, R3, and R5 (equivalently, by prefixes P1, P3, and P5). So, N1, N3, and N5 are candidates for the next hop for incoming packets that are destined for address 18. Which of the matching rules (and associated action) should be selected?*

When more than one rule matches an incoming packet, a tie occurs. To select one of the many rules that may match an incoming packet, we use a tie breaker." The preceding text excerpt clearly indicates that the rule associated with the filter will be applied to the key, and that the rule applies to all destination addresses associated with the filter.) (Page 2, Column 1, Paragraph 4).

As per Claims 2 and 12, Sahni discloses the search method includes at least a binary search (i.e. *"Lampson, Srinivasan, and Varghese [10] have proposed a data structure in which the end points of the ranges defined by the prefixes are stored in ascending order in an array. LMP(d) is found by performing a binary search on this ordered array of end points."* The preceding text excerpt clearly indicates that the search method includes a binary search.) (Page 3, Column 2, Paragraph 3).

As per Claims 3 and 13, Sahni discloses the search method determines if the provided key is equal to a single key associated with one object in the table (i.e. Section 2.2 clearly indicates that the filters matching the given key (d) are found using the filter end points. If the filter consists of a single address, that single address would be used for both end points and the key matching will be identified.) (Page 4, Column 1, Paragraph 1).

As per Claims 4 and 14, Sahni discloses the search method determines if the provided key is equal to a lower bound of a key range associated with one object in the table (i.e. Section 2.2 clearly indicates that both the lower and upper bounds are used to identify the key ranges/filters that match the provided key.) (Page 3, Column 2, Paragraph 5; Page 4, Column 1, Paragraph 1), wherein the other search method operates in a descending direction across the table (i.e. *"Most-specific-rule matching. The filter F1 is more specific than the filter F2 iff F2 matches all packets matched by F1 plus at least one additional packet. So, for example, the range [2; 4] is more*

specific than [1; 6], and [5; 9] is more specific than [5; 12]. Since [2; 4] and [8; 14] are disjoint (i.e., they have no address in common), neither is more specific than the other. Also, since [4; 14] and [6; 20] intersect2, neither is more specific than the other. The prefix 110 is more specific than the prefix 11*. In most-specific-rule matching, ties are broken by selecting the matching rule that has the most specific filter. When the filters are destination prefixes, the most specific- rule that matches a given destination d is the longest prefix in filters(d). Hence, for prefix filters, the most-specific-rule tie breaker is equivalent to the longest-matching-prefix criteria used in router tables. For our example rule set, when the destination address is 18, the longest matching-prefix is P4."* As per the description of the other search method, the table may be searched in either an ascending or descending direction across the table, depending on whether the results (e.g. matching key ranges) from the first search method are pushed on to a stack or a queue.) (Page 2, Column 2, Paragraphs 6-7; Page 3, Column 1, Paragraph 1).

As per Claims 5 and 15, Sahni discloses the search method determines if the provided key is equal to an upper bound of a key range associated with one object in the table (i.e. Section 2.2 clearly indicates that both the lower and upper bounds are used to identify the key ranges/filters that match the provided key.) (Page 3, Column 2, Paragraph 5; Page 4, Column 1, Paragraph 1), wherein the other search method operates in an ascending direction across the table (i.e. *"Most-specific-rule matching. The filter F1 is more specific than the filter F2 iff F2 matches all packets matched by F1 plus at least one additional packet. So, for example, the range [2; 4] is more specific than [1; 6], and [5; 9] is more specific than [5; 12]. Since [2; 4] and [8; 14] are disjoint (i.e., they have no address in common), neither is more specific than the other. Also, since [4; 14] and [6; 20] intersect2, neither is more specific than the other. The prefix 110* is more specific than the prefix 11*. In most-specific-rule matching, ties are broken by selecting the matching rule that has the most specific filter. When the filters are destination prefixes, the most specific- rule that matches a given destination d is the longest prefix in filters(d). Hence, for prefix filters, the most-specific-rule tie breaker is equivalent to the*

longest-matching-prefix criteria used in router tables. For our example rule set, when the destination address is 18, the longest matching-prefix is P4." As per the description of the other search method, the table may be searched in either an ascending or descending direction across the table, depending on whether the results (e.g. matching key ranges) from the first search method are pushed on to a stack or a queue.) (Page 2, Column 2, Paragraphs 6-7; Page 3, Column 1, Paragraph 1).

As per Claims 6 and 16, Sahni discloses the key is at least one of an IP address or a telephone number (i.e. *"Each rule-table rule is a pair of the form (F;A), where F is a filter and A is an action. The action component of a rule specifies what is to be done when a packet that satisfies the rule filter is received...For the 1-dimensional packet classification problem, we assume that the single field in the filter is the destination field and that the action is the next hop for the packet."* The preceding text excerpt clearly indicates that key is a destination address (e.g. IP address).) (Page 1, Column 1, Paragraph 1. Column 2, Paragraph 1).

As per Claims 7 and 17, Sahni discloses the key is the IP address and information associated with the object includes at least one of a bound IP address, sister bound IP address, type, index, sister index, or rule (i.e. *"Henceforth, we shall use the terms rule table and router table to mean tables in which the filters have a single field, which is the destination address."* The preceding text excerpt clearly indicates that the information associated with the object is a bound IP address/destination address.) (Page 1, Column 2, Paragraph 3).

As per Claim 8, Sahni discloses the table includes at least an array, wherein the information associated with each object is sorted in the array (i.e. See figure 1 in which the ranges (of IP addresses) are sorted in an array by lower bound.).

As per Claims 9 and 19, Sahni discloses wherein the other search method further includes: searching from the starting entry in a descending direction across the table to iteratively determine a lower bound of the smallest key range (i.e. *"Most-specific-rule matching. The filter F1 is more specific than the filter F2 iff F2 matches all packets matched by F1 plus at least one additional packet. So, for example, the range [2; 4] is more specific than [1; 6], and [5; 9] is more specific than [5; 12]. Since [2; 4] and [8; 14] are disjoint (i.e., they have no address in common), neither is more specific than the other. Also, since [4; 14] and [6; 20] intersect2, neither is more specific than the other. The prefix 110* is more specific than the prefix 11*. In most-specific-rule matching, ties are broken by selecting the matching rule that has the most specific filter. When the filters are destination prefixes, the most specific- rule that matches a given destination d is the longest prefix in filters(d). Hence, for prefix filters, the most-specific-rule tie breaker is equivalent to the longest-matching-prefix criteria used in router tables. For our example rule set, when the destination address is 18, the longest matching-prefix is P4."* As per the description of the other search method, the table may be searched in either an ascending or descending direction across the table, depending on whether the results (e.g. matching key ranges) from the first search method are pushed on to a stack or a queue. Also note that as the size of the range is being checked, both the lower and upper bounds will be iteratively determined) (Page 2, Column 2, Paragraphs 6-7; Page 3, Column 1, Paragraph 1), wherein the other search method enables jumping over other objects in the table to determine the lower bound (i.e. Note that as per the above description, only the filters/ranges identified to match the key are searched, thus some ranges/filters/objects in the table are bypasses/jumped.); and enabling the processing of the given key based on at least one rule associated with an object that is associated with the lower bound (i.e. *"In most-specific-rule matching, ties are broken by selecting the matching rule that has the most specific filter."* The preceding text excerpt clearly indicates that the key is processed

using the rule associated with the smallest matching key range, as determine using the lower bound of the smallest key range.) (Page 2, Column 2, Paragraph 7).

As per Claims 10 and 20, Sahni discloses wherein the other search method further includes: searching from the starting entry in an ascending direction across the table to iteratively determine an upper bound of the smallest key range (i.e. *"Most-specific-rule matching. The filter F1 is more specific than the filter F2 iff F2 matches all packets matched by F1 plus at least one additional packet. So, for example, the range [2; 4] is more specific than [1; 6], and [5; 9] is more specific than [5; 12]. Since [2; 4] and [8; 14] are disjoint (i.e., they have no address in common), neither is more specific than the other. Also, since [4; 14] and [6; 20] intersect2, neither is more specific than the other. The prefix 110* is more specific than the prefix 11*. In most-specific-rule matching, ties are broken by selecting the matching rule that has the most specific filter. When the filters are destination prefixes, the most specific- rule that matches a given destination d is the longest prefix in filters(d). Hence, for prefix filters, the most-specific-rule tie breaker is equivalent to the longest-matching-prefix criteria used in router tables. For our example rule set, when the destination address is 18, the longest matching-prefix is P4."* As per the description of the other search method, the table may be searched in either an ascending or descending direction across the table, depending on whether the results (e.g. matching key ranges) from the first search method are pushed on to a stack or a queue. Also note that as the size of the range is being checked, both the lower and upper bounds will be iteratively determined) (Page 2, Column 2, Paragraphs 6-7; Page 3, Column 1, Paragraph 1), wherein the other search method enables jumping over other objects in the table to determine the upper bound (i.e. Note that as per the above description, only the filters/ranges identified to match the key are searched, thus some ranges/filters/objects in the table are bypasses/jumped.); and enabling the processing of the provided key based on at least one rule associated with an object that is associated with the upper bound (i.e. *"In most-specific-rule matching, ties are broken by selecting the matching rule*

that has the most specific filter." The preceding text excerpt clearly indicates that the key is processed using the rule associated with the smallest matching key range, as determine using the upper bound of the smallest key range.) (Page 2, Column 2, Paragraph 7).

As per Claim 18, Sahni discloses the network device operates as at least one of a router, firewall, switch, hub, or server array controller (i.e. *"An Internet router classifies incoming packets into flows utilizing information contained in packet headers and a table of (classification) rules. This table is called the rule table (equivalently, router table)."* The preceding text excerpt clearly indicates that the network device is a router.) (Page 1, Column 1, Paragraph 2).

Points of Contact

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Hicks whose telephone number is (571) 272-2670. The examiner can normally be reached on Monday - Friday 10:00a - 7:00p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jeffrey Gaffin can be reached on (571) 272-4146. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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